Removal efficiency of propolis paste dressing from the root canal

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ABSTRACT

Objetives: The aim of this study was to investigate through scanning electron microscopy (SEM) the cleaning of root canal walls after the use of experimental propolis or calcium hydroxide root canal dressings. Material and Methods: Twenty single-rooted teeth were used. After conventional cleaning and shaping procedures and removal of the smear layer with 17% EDTA, the teeth were divided into four groups according to the medication used (N=5): Group I (control) – No drug, Group II - Calcium hydroxide dressing, Group III – Propolis paste A70D and Group IV – Propolis paste D70D. The medications were introduced into the root canals and maintained for 7 days, then removed with a K-file and 5 mL of 1% sodium hypochlorite irrigation. Finally, the canals were flushed with 2 mL of 17% EDTA for 3 min. For SEM analysis, the roots were cleaved and microphotographs from the middle third of the root canal were taken at 750x. The cleaning of the root canal walls was determined by the number of open dentinal tubules as verified with the software Image Tool 3.1. The statistical analysis was performed by ANOVA and Tukey's test ($p<0.05$). Results: The results showed no statistically significant difference between the calcium hydroxide and propolis groups. Conclusions: The experimental propolis pastes presented acceptable physical characteristics to be used as intracanal medicaments.

Key words: Propolis. Endodontics. Dentin. Scanning electron microscopy.

INTRODUCTION

Root canal dressings are used usually during the endodontic treatment of teeth with apical periodontitis. Calcium hydroxide is considered the standard intracanal medication because of its antibacterial effect[16]. However, clinical studies have shown that it is not possible to sterilize the root canals in necrotic teeth even using calcium hydroxide dressings[2,9]. For these reason, new compounds as chlorhexidine, antibiotics, and natural compounds as propolis has been suggested to be used as alternative intracanal medications.

Propolis in its crude form, as an extract, is not ideal for the endodontic use, therefore shows characteristic resinous and sticky[10]. After successive biological and microbiological studies, Victorino, et al.[18] (2009) reached a propolis paste formulation for endodontic use using the lowest concentration of crude extract of propolis which retains its biological activity. Other authors have shown that propolis can be useful as a root canal dressing due to its low toxicity and broad antibacterial spectrum[12,15].

In addition to the antimicrobial properties, intracanal medications must be easily removed from the root canal walls[3,11]. The obstruction of dentinal tubules, by either smear layer or intracanal medication can impair the performance of the endodontic sealers. The penetration of the sealers into dentinal tubules improves the seal by increasing the contact surface to the root canal walls[5,19].

The purpose of this study was to evaluate the cleaning of the root canal walls after the placement of calcium hydroxide- or propolis-based intracanal medications, using scanning electron microscopy (SEM).

MATERIAL AND METHODS

Twenty freshly extracted single-rooted human teeth from the Department of Dental Materials, Restorative Dentistry and Endodontics, Bauru School of Dentistry, Brazil, were used. Conventional pulp chamber access procedures using spherical diamond and Endo Z drills (Dentsply Ind. e Com. Ltda., Petrópolis, RJ, Brazil) were used and the working length determination was established at 1 mm from the apical foramen using a 10 K-file. Cleaning and shaping of the root canals was performed until the diameter of a 60 K-file using 1 ml of 1% sodium hypochlorite. A final rinse with 2 mL of 17% EDTA for 3 min and finally 1 mL of 1% sodium hypochlorite were used. The root canals were dried using conventional paper points, and the teeth were divided into four experimental groups (N=5). Group I - No drug (control), Group II - Calcium hydroxide/distilled water paste, Group

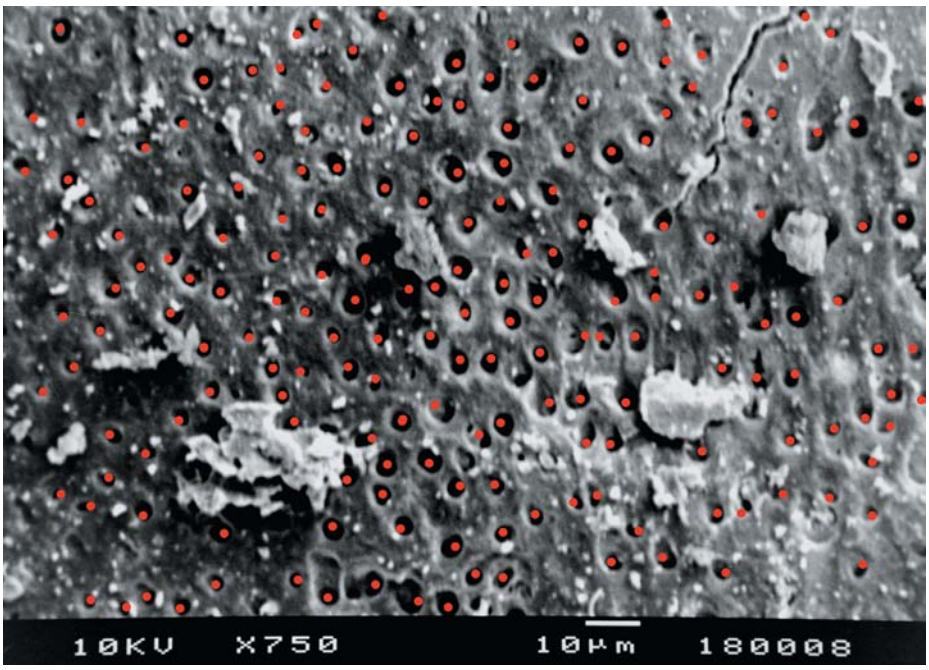

Figure 1- Model used for counting dentinal tubules. Red points, open dentinal tubules (Image Tool software). Scanning electron microscopy

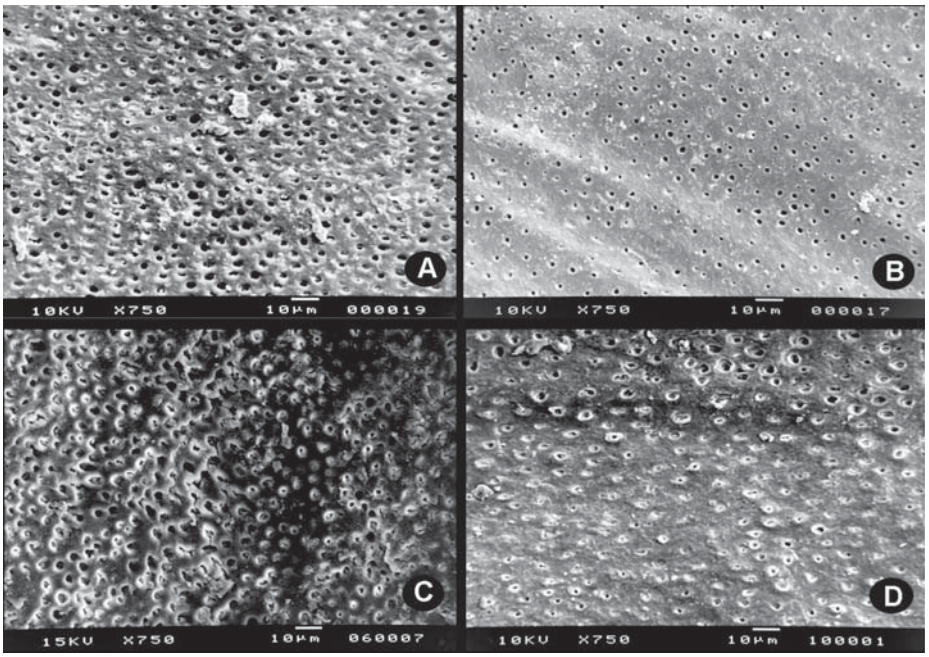

Figure 2- Scanning electron microscopy micrographs representative of the four groups: A – Control (no drug); B – $Ca(OH)_2$; C – Propolis paste A70D; D – Propolis paste D70D

III – Propolis paste A70D, Group IV - Propolis paste D70D. The pastes were introduced into the root canals using an engine driven lentulo instrument (Dentsply Ind. e Com. Ltda.). After 7 days, the medications were removed using a K- file and 5 mL of 1% sodium hypochlorite. Finally, the canals were flushed with 2 mL of 17% EDTA for 3 min, and final irrigation was performed with 1 mL of saline.

For SEM analysis, the crowns of teeth were removed and the roots were cleaved using a hammer and chisel. The root segments were sputter-coated with gold in a sputter-coating unit (Denton Vacuum Inc., Morristown, NJ, USA) and the middle third of the root canal walls examined at 750x with a scanning electron microscope (JSM, 220A, JEOL Tokyo, Japan). Cleaning of the root canal walls was analyzed with regard to the number of patent dentinal tubules using the Image Tool 3.1 software (UTHSCSA, San Antonio, Texas, USA) (Figure 1). The measurements were repeated twice to ensure reproducibility. Statistical analysis was performed to show differences in the number of open dentinal tubules among the four analyzed groups using ANOVA and Tukey's test ($p<0.05$).

RESULTS

Cleaning of the root canal walls was indicated by the mean of number of patent dentinal tubules. The non-medicated control group was significantly cleaner than the others, with a larger number of patent dentinal tubules (229.8±42.04) ($p<0.05$).

There was no statistically significant difference ($p>0.05$) among the other groups - Group II (calcium hydroxide: 142.3±67.02), Group III (Propolis paste A70D: 127±11.69) and Group IV (Propolis paste D70D: 147.3±36.51) - showing that cleaning of the root canal walls decrease after the use of the intracanal medications.

A panel of representative SEM micrographs of the four experimental groups is shown in Figure 2.

DISCUSSION

Interference of the smear layer or intracanal medications decrease the sealing ability of endodontic sealers[6,13,19], and it is basically due to the difficulty to remove them from the root canal walls, as demonstrated by Porkaew, et al.[14] (1990) and Calt & Serper[3] (1999). As propolis paste is an experimental drug, it was necessary to know the performance of this material, after its introduction and removal from root canals.

The choice for the use of sodium hypochlorite and EDTA, as a final rinse, was based on previous studies[1,8,17]. The analysis of the middle root canal third was defined by the findings of other authors[4,17,20], who described the facility to view the dentinal tubules at the middle and cervical third due to the larger these regions in comparison to the apical third, allowing greater movement of irrigating solutions facilitating the removal of smear layer and consequently the intracanal medication.

The results of this study confirmed the findings of the literature about the difficulty of cleaning the root canal walls after use of calcium hydroxide dressing. In contrast, when the root canals did not receive the intracanal medication, only final cleaning with sodium hypochlorite and EDTA, the dentinal tubules were cleaner without the presence of smear layer in comparison to the groups that received medication. The difficulty to eliminate the experimental propolis pastes was similar to that observed for calcium hydroxide and, in some cases, it was observed the presence of precipitations, as reported by Giamalia, et al.[7] (1999). It should be noted the effect of EDTA on the intracanal medicaments because the findings of a pilot-study showed that without its use the canal walls were completely smear-covered with no patent dentinal tubules.

Since there was no difference between the two propolis pastes in this experimental study, the election of one of the pastes over the other will depend on their performance in biological studies, which are currently being developed.

CONCLUSION

Removal of experimental propolis pastes from the root canals was difficult and similar to that observed for calcium hydroxide paste, which is a standard intracanal dressing. Therefore, the experimental propolis pastes A70D and D70D presented acceptable physical characteristics to be used as intracanal medicaments.

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